

A Black Box Alert System for Crash Recovery and Prediction using MEMS Technology

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Abstract— In this paper we proposed the GPS (Global Positioning System) GSM (Global System for Mobile Communication) and wireless black box using MEMS accelerometer and accidental monitoring is developed for GPS tracking system. This system consists of co-operative components of an, microcontroller unit, accelerometer, GPS device will send mobile phone short message indicating the position of vehicle by GPS system to family member, emergency medical service (EMS) and near hospital. It easy to install under rider seat. It used for threshold algorithm and speed of motorcycle are used to determine fall or accident in real time.

Keywords— MEMS accelerometer, GPS device, GSM module, emergency medical service (EMS), LDR, real time monitoring

I. INTRODUCTION

The motorcycle accident is a major public problem in many countries. This problem still increasing riders due to poor behaviors such as drunken driving, speed driving with no helmet production, riding without sufficient sleep, in a critical situation many vehicles faces accident, lost their lives due to this lot of person. But because of lack of information Some people can be saved at that time and place it may not be possible. One of the disadvantage in this project will provide an optimum solution. According to this project when a vehicle met with an accident immediately occurs then message is sending from vehicle number and persons contact number will be transferred to police control room or a rescue team. So the police can immediately trace the location from where the message came. Next application is used from accelerometer can be used in a car alarm application an uncertain situation many of vehicles. Dangerous driving can be detected with an accelerometer. It is used as a crash recorder for

tracking vehicle before, during and after a crash. With signals from an accelerometer, a severe accident can be detected. In third application on an uncertain situation many of vehicle that

has center locking system, Such as faces many problem due to door

locking system and automatic locking system. It will provide a suitable solution for this situation by using wireless or GSM technology. When a vehicle met with an accident the message came to control room or a rescue team by using GPS and GSM Technology. GPS technology uses 24 satellites for communications that transmit signals globally around the clock. With a GPS receiver, one can quickly and accurately determine the latitude, the longitude, and in most cases the altitude of a point on or above Earth's surface. GSM use a Subscriber Identity Module (SIM) smart card that contains user account information. Mobile phone using GSM technology gets programmed immediately after plugging in the SIM card. Here an accelerometer (MEMS) is used in a car alarm application; MEMS accelerometer is a powerful yet simple software tool for engineers, researchers and students working in the field of Micro Electro Mechanical Systems Dangerous driving can be detected with an accelerometer. It can be used as a crash recorder of the vehicle movements before, during and after a crash. With signals from an accelerometer, can be severe accident can be recognized. Our project will provide a suitable solution for this situation.

II. SYSTEM OVERVIEW

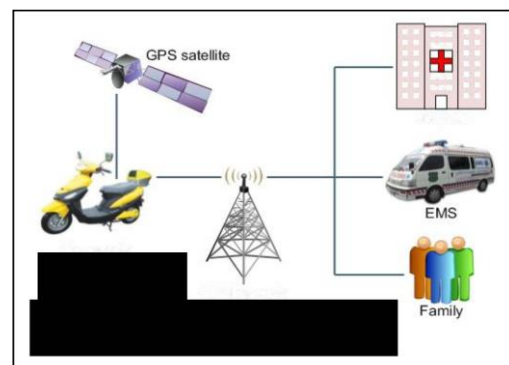


Figure.1. system architecture

a. Accidents Statistics

In existing system is most of the people associate black box with airplanes but they are no longer just the key tool in investigation of accidents in aero plane. Presently tracking

system is introduced in vehicles to avoid the accidents and save peoples life. But these systems are still installed in some of the high end motorcycles only because these systems are too expensive for most of the motorcycle riders. This project we are introducing fall detection and alarm system which is expected to save peoples life by detecting the accidents occurred and provides help by tracing the location of the motorcycle riders with the help of GPS technology. This provides the information of the motorcycle rider if any accident is occurred to the family members and at the same time it sends a message to the nearest hospital for the help.

b.Design of proposed hardware system

The process of working is explained as follows, the total equipment is placed inside a vehicle but it is not visible to others. The MEMS accelerometer will sense the movement of the vehicle continuously. When an accident occurs, the movement of the vehicle will be detected by the MEMS and this information is given to microcontroller. The GPS module is used to track the location of the vehicle when the accident has occurred. GPS can get the graphical location values are displayed on the LCD (Liquid Crystal Display). We are also having head light brightness monitoring system, which automatically detect the opposite vehicle and reduce the head light brightness of our vehicle automatically.

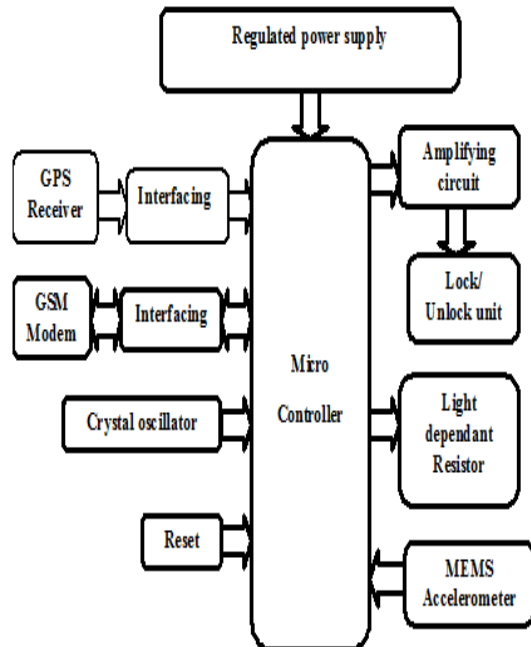


Figure.2.Block diagram of hardware system

MEMS

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication

technology. MEMS technology allows the development of smart products, its computational ability. The devices and structures that are made using the technique is micro fabrication. An accelerometer is electromechanically device that measure acceleration force. Many types of accelerometers developed and reported in the literature, it is based on piezo-electric crystals, is too big and clumsy. This technology is coming from diverse industries such as automotive, space and consumer electronics. MEMS promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the realization of complete systems-on-a-chip.

c.Vibration sensor

Vibration sensors detect the vibration of the ground soil in case of a debris flow to installing a Vibration Sensor is mounted at the bottom of the unit. It should be fixed with the vibrating body firmly the sensitivity is adjusted for the required vibration/shock is detected the output goes low and the delay is provided for proper operation vibrating frequency and amplitude can be detected. It is also important to keep in mind the caused by earthquakes, risk of unintentional activation as well as areas in which there is construction traffic and other vibration causes that may activate the sensor. The unforeseen machinery damage can be prevented. The plant engineer has the opportunity to detect the pending problems schedule and reduce downtime in a cost effective manner.

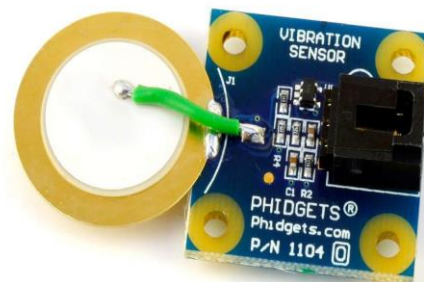


Figure.3.vibration sensor

III.GPS TECHNOLOGY

The Global Positioning System (GPS) is a satellite based navigation system that can be used to locate positions anywhere on earth. Designed and operated by the U.S department of defense, it consists of satellites and uses triangulation to calculate a user exact location. GPS is used on incidents in a variety of ways, such as:

- To determine position locations for example, you need to radio a helicopter pilot the coordinates of your

position location so the pilot can pick you up.

□ To navigate from one location to another, for example, you need to travel from a lookout to the fire perimeter.

□ To create digitized maps for example, you are assigned to plot the fire perimeter and hot spots. To determine distance between two points or how far you are from another location.

a. How the Global Positioning System Works

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. with distance measurements from a few more satellites. It must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and the user 3D position (latitude, longitude and altitude) track movement of GPS receiver. With four or more satellites in view, Once the user position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset

b. LDR

A light dependant resistor is also know as a LDR, photo resistor, photoconductor or photocell, is a resistor whose resistance increases or decreases depending on the amount of light intensity. LDRs (Light Dependant Resistors) are a very useful tool in a light or dark circuits. A LDRs can have a variety of resistance and functions.

How it Works

The way an LDR works is that they are made of many semi conductive materials with high resistance. The reason they have a high resistance is that are very few electrons that are free and able to move because they are held in a crystal lattice and are unable to move. When light falls on the semi conductive material it absorbs the light photons and the energy is transferred to the electrons, which allow them to break free from the crystal lattice and conduct electricity and lower the resistance of the LDR have low cost and simple structure. They are used when there is a need to detect absences or presences of light like in a camera light meter.

Uses

Light dependant resistors have many uses, many of the uses have to do with objects that have to work in certain levels of light. Some of the uses of the LDR are in photographic light meters, street lights and various alarms' light burglar alarms, re alarms and smoke alarms.

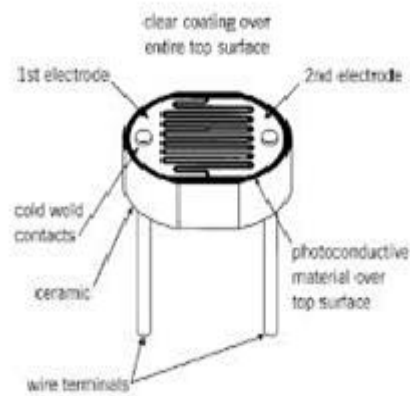


Figure.4. typical construction of a plastic coated photocell

c. How Does GPS Technology Work?

The control segment constantly monitors the GPS constellation and uploads information to satellites to provide maximum user accuracy. GPS receiver collects information from the GPS satellites that are in view. For more information, refer to the Sources of errors. GPS receiver determines your current location, velocity, and time. GPS receiver can calculate other information, such as bearing, sunset time, track, trip distance, and distance to destination, and sunrise. GPS receiver displays the applicable information on the screen.



Figure.5. GPS system

d. GSM (Global system for mobile communication)

Definition

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. A GSM modem is a wireless modem that works with a GSM wireless network. The wireless modem behaves like a dial-up modem fixed telephone line sends and receives data through radio waves. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. As mentioned in earlier sections of this SMS tutorial, computers use AT commands to control modems. GSM modems and dial-up modems support a common set of standard AT commands. You can use a GSM modem just like a dial-up modem.

Description

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standard for AT command. AT commands like a reading, writing and deleting SMS messages sending, monitoring the signal strength, searching phone book entries, and charging status and charge level of the battery. Applications for voice calls, SMS, GSM data calls.

The AT commands are given to the GSM modem with the help of PC or controller. The GSM modem is serially interfaced with of MAX 232 controller with the help. Here max 232 acts as driver which converts TTL levels to the RS 232 levels. For serial interface GSM modem requires the signal RS 232 based on the RS232 port, we see two pins which are certainly used for flow control. These two pins are RTS, request to send and CTS, clear to send. With DTE/DCE communication. This application suitable for GSM communication is used for short data size, multiple remote data collection points, high up time, large transaction volumes, mobility, quick installation.



Figure.6. GSM modem

HARDWARE DESCRIPTION

The system consists of cooperative components of an accelerometer, microcontroller unit (MCU), GPS device and GSM module for sending a short message. An accelerometer is applied for awareness and fall detection indicating an accident. The speed of motorcycle and Embedded C algorithm are used to decide a fall or accident in real-time. Mobile short message containing position from GPS (latitude, longitude) will be sent when motorcycle accident is detected. The robust package design is implemented so that it is safe from water's spray and dust in environment. The module is aimed to be installed under the motorcycle seat. A high performance 16 bits MCU is used to process and store real-time signal from the accelerometer. Thus, this device is analogous to a black box in airplane. The police and insurance examiner can obtain accident history to investigate accident situation from data-logger in this device. Moreover, this device can be used to track motorcycle after it was stolen but it can't operate in real-time in this case.



Figure.7. hardware result

IV.RELATED WORK

Despite awareness campaign, this problem is still increasing due to rider's poor behaviors such as speed driving, drunk driving, riding. We can avoid these accidents by providing the alcohol sensors to the drivers. In other application, if comparing the predetermined values in the microcontroller and the alert message is displayed on the LCD. Meanwhile the motor gets stopped and driver is in safe condition, We are also having head light brightness monitoring system, which automatically detect the opposite vehicle and reduce the head light brightness of our vehicle automatically.

V.CONCLUSION

The system wireless black box using MEMS accelerometer and GPS tracking has been developed for motorcycle accidental monitoring. The system can detect the type of accident from accelerometer signal using threshold algorithm, posture after crashing of motorcycle and GPS ground speed. After accident is detected, short alarm message data (alarm message and position of accident) will be sent via GSM network. We are also having head light brightness monitoring system, which automatically detect the opposite vehicle and reduce the head light brightness of our vehicle automatically.

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